

Art Unit: 1744

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In the Specification

Please replace the paragraph beginning on page 11, line 9 with the following amended paragraph:

In the embodiment illustrated, membranes 34 and 36 cover exposed portions of fluid pathway 84 facing upward or downward as illustrated. Membranes 34 and/or 36 can be any membranes suitable for separation, i.e. extraction of product through the membrane with passage of effluent, or carrier fluid, through outlet 82. Those of ordinary skill in the art will recognize a wide variety of suitable membranes including size-selective membranes, ionic membranes, and the like. Upper and lower extraction solvent fluid units 30 and 32, which can comprise materials as described above including etched silicon, each include a fluid pathway 86 connecting an inlet 88 with an outlet 90. Fluid pathway 86 preferably is positioned in register with fluid pathway 84 of unit 18 when the separation unit is assembled. In this way, two flowing streams of solvent through channels 86 of units 30 and 32 flow counter to the direction of flow of fluid in channel 84 of unit 18, the fluids separated only by membranes 34 and 36. This establishes a counter-current tangential flow filtration membrane system. By concentration gradients, products are selectively extracted from channel 84 into solvent streams flowing within channels 86 of unit 30 or 32. Product is recovered through the outlet 90 of units 30 or 32 and recovered in a container (not shown) having a volume that can be greater than 1 liter. Outlets 90 thereby define carrier fluid outlets, and a fluid pathway connects inlet 80 of unit 18 with the carrier fluid outlets 90 of units 30 and 32, breached only by membranes 34 and 36. Carrier fluid outlet 82 can be made connectable to a recovery container for recycling of reaction carrier fluids. In the example of a microbioreactor, residual oxygen and nutrients are recovered from outlet 82 and recycled back into the feed for the process.